

A REVISION OF THE GENUS DYSOLOBIUM (PAPILIONACEAE) AND THE TRANSFER OF SUBGENUS DOLICHOVIGNA TO VIGNA

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SUMMARY

Dysolobium is a small legume genus, consisting of 4 species. It is closely related to *Vigna*, from which it differs by the shape of the wing petals and by the velvety, almost woody pods. Recently the genus has been divided into 2 subgenera, but in this paper the subgenus *Dolichovigna* is transferred back to *Vigna*.

Possible relations between *Dysolobium* and genera as *Vigna*, *Phaseolus*, *Canavalia*, *Dolichos*, *Psophocarpus*, and *Pueraria* are discussed. *Vigna* seems to be the most closely related genus.

Dysolobium is a Southeast Asian genus, two species of which are endemic and two more widespread; one of the latter ranges from India to Java (not extending more eastwards). The plants prefer a climate with a seasonal drought.

Vigna pilosa is the only species in *Vigna* subgenus *Dolichovigna*. *Vigna clarkei* is excluded from this subgenus.

INTRODUCTION

Bentham (1852) was the first to describe *Dysolobium* (Greek: *dus* = bad or *dysodes* = ill-smelling, *lobion* = pod; non-eatable fruit or ill-smelling pod) as a section of *Phaseolus*, containing three species: *P. grandis*, *P. lucens*, and *P. dolichoides*. He did this in a footnote, which is rather symptomatic for the way this genus has always been treated. The generic delimitation is rather weak, therefore every author treated the taxonomic level and the contents of this taxon differently, with the present revision as no exception. Transferences of parts of this taxon to other genera, especially to *Vigna* are often advocated.

In 1865, Bentham incorrectly added a fourth species to this section: *P. fuscus* (as a literature reference to Wallich). Kurz (1876) correctly transferred this to *Dunbaria* (belonging to the subtribe Cajaninae, legumes covered with typical glands).

In 1874, Kurz (after Wallich) suggested (!) to transfer *Dysolobium* to *Canavalia*. In 1876 he made some new combinations in *Canavalia*. Unfortunately, literature refers to 1874 as the publication of the new combinations. In a note under *Dysolobium grande* it is explained why the transference to *Canavalia* is taxonomically incorrect.

Baker (1876) treated *Dysolobium* as a subgenus of *Phaseolus*, only containing the two species with the longest, almost spiral keel: *P. grande* and the incorrectly placed *P. fuscus*. *Phaseolus lucens* and *P. dolichoides* were placed in the subgenus *Plectotropis* of *Vigna* (this subgenus, together with *Dysolobium*, connected in Baker's opinion, *Vigna* with *Phaseolus*). In subgenus *Plectotropis* Baker described *Vigna pilosa* as new.

Prain (1897) established the genus *Dysolobium*, in which he distinguished *D. grande*, *D. dolichoides* and *D. lucens*. He described *D. tetragonum* as new. *Vigna pilosa* remained in *Vigna*. According to Prain, the firm, septate pods and the hirsute seeds were characteristic for this genus, although the pods of *V. pilosa* strongly resemble those of *Dysolobium*. This classification is for instance followed by Backer & Bakhuizen van den Brink f. (1963) and Verdcourt (1970a, b).

Gagnepain (1916) transferred *Dysolobium* to *Dolichos* and described, among others, *D. apioides* and *D. schomburgkii* as new (in this paper the first is a synonym of *Vigna pilosa*, the second of *Dysolobium dolichoides*).

Hayata (1919) described the genus *Dolichovigna*, indicating its intermediate position between *Dolichos* and *Vigna*. *Dolichovigna formosanum* and *D. rhombifolia* appeared to be synonymous with *Vigna pilosa*.

Maréchal (1977) and Maréchal et al. (1978) transferred all mentioned species back to *Dysolobium* and established two subgenera: *Dysolobium* (with *D. dolichoides*, *D. grande* and *D. lucens*) and *Dolichovigna* (*D. pilosum*, *D. apioides*), an opinion followed by Thuân (1979).

The present study maintains Prain's original concept (1897). Only the subgenus *Dysolobium* remains in *Dysolobium*, subgenus *Dolichovigna* is regarded as a subgenus of *Vigna*.

MORPHOLOGICAL NOTES

Leaves

The pinnately trifoliolate leaves are spirally arranged. The leaflets show the characteristic scalariform venation pattern of many Phaseoleae. The lateral leaflets are usually somewhat smaller than the terminal one, and asymmetric, with the basiscopic side larger than the acroscopic side.

The indumentum consists generally of uniseriate hairs only, the latter are usually bulbous based. The term bulbous based in this context is different from the one used by Lackey (1978). He describes the bulbous hairs of the Cajaninae as bulbous based hairs, but these hairs still possess a small stalk between bulb and base and ought to be named differently.

Of *Dysolobium dolichoides* an occasional specimen also has stalked glands, multicellular glands on a uniseriate, 1- or 2-celled stalk. Lackey (1978) records them also for *D. grande*; like in *D. dolichoides* only some specimens possess them. *Calopogonium mucunoides* (Diocleinae) also has these stalked glands; again not all plants possess them: Lackey, for instance, records *C. mucunoides* as devoid of glands. The only leaflet of *Dysolobium grande* dissected by us, did not show glands, but a fungoid infection, which appeared as black, small (0.02 mm) glands. They consist of an epi-

dermal outgrowth with the hyphae radially arranged (Baas & Werker, pers. comm.).

The small, stalked glands are quite unlike the large, typical glands of the *Cajaninae*, which are described as vesicular glands. The glands of *Cajanus elongatus* are globular, with a layer of large epidermal cells; inside small cells, continuing from gland to opposite epidermis, enveloping a small nerve. *Cajanus elongatus* also has the small, stalked glands.

Inflorescences — Fig. 1a

The inflorescences are axillary pseudoracemes, panicles with the lateral branches contracted into brachyblasts. The latter are small, often black and cushion-shaped; they bear 2 or 3 flowers. *Dysolobium tetragonum* shows a transition in its 2-flowered brachyblasts with a reduced third one present.

The rachis varies strongly in length, from 2.5 cm in *D. tetragonum* to over 70 cm in *D. grande*, but all have a relatively long peduncle and a shorter flower-bearing part.

At the base of the inflorescence dormant buds, consisting of several bracts (fig. 1g), can be observed.

The bracts to the brachyblast and the bracts to the flowers are usually early caducous.

Bracteoles

In all species two opposite bracteoles are present on the top of the pedicel, just below the calyx. They are ovate to reniform, pubescent and usually subsistent in fruit.

Calyx

The calyx possesses four short lobes, of which the upper one has a bifid apex. The lower lobe is about 1.5–2 times as long as the other three. In bud the lobes are somewhat imbricately folded, but because they are relatively short, this is less distinct than in, for instance, buds of *Mastersia* (Van Welzen & Den Hengst, 1984).

The calyx is usually (sub)persistent in fruit.

Standard

The standard is shortly clawed. Lateral auricles are usually present, often rolled or folded inwards. The basal callosities are absent to slightly developed. The apex is retuse and has a slight, backward pointing fold.

Wings — Fig. 1b (compare also fig. 2b)

Besides the relatively long, slender claw, the wings have two auricles, a long and slender upper one and a small lower one. The latter is situated about halfway the blade. The upper margin of the wings is hemi-circular. A lateral pocket is absent or only slightly developed.

Keel — Fig. 1a (full-grown flowers)

The keel has a long and slender claw. The blade shows a bent (under almost a right angle), dividing the blade into a horizontal and a vertical part; the horizontal part has

a hemi-circular upper margin, sometimes developed into an upper auricle. The lateral pocket is usually absent.

Three species of *Dysolobium* show a remarkable feature, as the apices of both partly connate blades are elongated and tube-like. *Dysolobium dolichoides* shows this less well-developed, like *D. lucens*, while *D. grande* has a very elongated and bent tube, giving the flower somewhat the appearance of *Phaseolus*; the tube can almost be bent into a full circle. *Dysolobium tetragonum* lacks this tube.

Stamens

The vexillary stamen is completely free from the other nine, but may basically form a loop, like encountered in Papilionoideae with all ten stamens at least partly connate. In *D. dolichoides* and possibly *D. lucens* the stamens are alternately longer and shorter, in the other species they are all of equal length.

Style – Fig. 1c & d (compare fig. 2c & d)

The style has an apical tuft of hairs on the upper side, obliquely surrounding the stigma.

Presumably, the species of *Dysolobium* are self-fertilizing: the stamens develop before the style develops and are forced through the tubular apical elongation of the keel, if present, loosing pollen on their way up. Afterwards the style elongates and the tuft of hairs, like a broom, takes along the pollen grains, which one finds on the sticky stigma. The sometimes large number of developed pods, with every seed in it mature (quite unlike *Mastersia*, where only a few seeds per pod mature; Van Welzen & Den Hengst, 1984), and the almost total absence of structures on the wings, which can act as landing platforms for pollinators, support the hypothesis of self-fertilization.

Pod – Fig. 1e (compare pods of fig. 2a)

The pods of *Dysolobium*, although characteristic for the genus, show differences among the species. Typical is the almost woody texture, the orbicular to subquadrangular transverse section, the velvety indumentum and the large septa. The latter are somewhat transverse and often 3-layered, as the mesocarp splits the endocarp into two and becomes visible between the then two layers of endocarp. The septa are absent in the young ovaries, in the young pods they start to develop as opposite enations of the endocarp and mesocarp, the septa are full-grown in mature pods.

The pods of *D. grande* and *D. tetragonum* have rims along the sutures (later on appearing as sunken). The pods are dehiscent along the sutures and open into spirals.

At both ends the pod is filled with a spongy tissue, which becomes papery when the pod is dried.

The funicle is of a very firm texture and ventrally enlarged into a lobe. The connection between funicle and aril is like a hand-shake: the aril, consisting of two unequal lateral lobes, envelops the funicle laterally, while ventrally the funicle overlaps the aril.

Seed – Fig. 2f

The seeds are horizontally or vertically arranged. They are glabrous or glabrescent. The plumule is minute, the bended radicle is dorso-ventrally flattened.

SYSTEMATIC POSITION

Dysolobium has always been treated as a member of the Phaseoleae-Phaseolinae. Hutchinson (1964) places *Dysolobium* in the Phaseoleae, while Lackey (1977), like Baudet (1977) even places this taxon in its subtribe Phaseolinae. The typical character of the Phaseolinae is the presence of hairs on the apical part of the further glabrous style. Baudet classifies *Dysolobium* in the Phaseolastrae (unnamed rank between subtribe and genus), contrasting with the Dolichastrae. This division is mainly based on hypothetical evolutionary developments in the style: starting with a bipartite style, there are, according to Baudet, three developments, first the upper part becomes dorso-ventrally flattened (spathulate) or the lower part disappears, leaving a short, broad style with between style and ovary a sinus (*Dolichos* type). In both cases the stigma remains terminal. These shapes are found in the Dolichastrae. The third development is found in the Phaseolastrae, which shows a division into spiralisation of the style or prolongation of the style beyond the stigma (later on becoming lateral, as in several species of *Vigna*).

Dysolobium, with its oblique stigma, ranks in the latter group. The differences between Dolichastrae and Phaseolastrae are supported by cytological and chemical evidence. The Phaseolastrae (style barbate) have $2n = 22$ chromosomes, they show a tendency towards the possession of S-methyl-cysteine and pipelicolic acid, no leuco-anthocyanides are found. The Dolichastrae (stigma velutinous) have $2n = 20$ chromosomes, no S-methyl-cysteine nor pipelicolic acid, while several genera possess leuco-anthocyanides. *Dysolobium* is not yet thoroughly checked for chemicals, but *D. grande* lacks leuco-anthocyanides (Baudet, 1977).

Possible links with other genera, as for instance *Pueraria* and *Canavalia*, are discussed in the notes on *Dysolobium grande*.

Lackey (1977) discusses the similarities between *Psophocarpus* and *Dysolobium*, and records the following shared characters:

1. – Fruits are heavy, septate within, and often four-winged.
2. – Beard on the style consists of multiseriate hairs.
3. – Stigma is concave and oblique.
4. – Keel petals are joined weakly and intermittently.
5. – Lower calyx lobe is prominent.
6. – Fascicle nodes are cushion-like and black.
7. – Seeds are velvety in *Dysolobium*, sometimes hairy in *Psophocarpus*.

Characters 4–6 are not typical for these two genera, but are found in many legumes; they are therefore omitted from the discussion below. The fruits of *Psophocarpus* bear broad wings, not rims; these wings are often frayed along the margin, especially when the fruit is young. The septae in the fruit are one-layered, and ventrally these septae are smaller or do not quite touch the endocarp. The seeds of *Psophocarpus* do not have an aril and the hilum is much longer, linear instead of ovate. Only *Dysolobium* has a beard, a tuft of hairs along the style (which also surround the stigma), but *Psophocarpus* has a whorl of hairs around the terminal stigma only and lacks the

hairs along the style. The stigma of *Psophocarpus* is terminal, not oblique. Baudet (1977) places both genera in completely different 'supergenera', because of these differences in style (see above); *Dysolobium* is placed in the Phaseolastreae and *Psophocarpus* in the Dolichastreae. Both genera have species with velvety hairs on the seeds. Conclusion: *Dysolobium* and *Psophocarpus* show similarities, as pointed out by Lackey (1977), but also many differences (Maréchal et al., 1978), which, in our opinion, are more striking than the former. Therefore, *Dysolobium* is related with *Psophocarpus*, but not as closely as with for instance *Vigna* (see below, and Maréchal et al., 1978).

It is more difficult to separate *Dysolobium* from the genera *Dolichos*, *Phaseolus* and *Vigna*, as was already indicated by Hayata (1919), with his description of his genus *Dolichovigna*.

Dolichos has a different type of style, the latter is somewhat flattened and has a constriction between style and ovary. The stigma is terminal, never oblique. The stigma is surrounded by a whorl of hairs, but the tuft of hairs along the style, as found in *Dysolobium*, is absent. The style of *Dysolobium* is filiform, without a constriction, with an oblique stigma and also with a tuft of hairs along the style.

Phaseolus always has a spirally coiled keel and style (coiling over more than 360°), *Dysolobium* never; only *D. grande* has a bent keel and style, always coiled for less than 360°. Verdcourt (1970b), Maréchal et al. (1978, 1981), and Maréchal (1982) use a somewhat different definition of *Phaseolus*: Verdcourt emphasizes the coiling habit, while Maréchal et al. (1981) consider the presence of hooked hairs, persistent floral bracts, absence of extrafloral nectaries (former two lacking in *Dysolobium*) typical for *Phaseolus*. Because of this restricted circumscription of *Phaseolus* by Verdcourt and even more by Maréchal et al., this genus is rather easily distinguished from *Dysolobium*.

So defined, *Phaseolus* has become a small genus and *Vigna* has enlarged very much and has become very variable (see table 1). Maréchal et al. (1978) describe 7 subgenera in *Vigna*: *Vigna*, *Plectotropis*, *Ceratotropis*, *Lasiocarpa*, *Sigmoidotropis*, *Haydonia*, and *Macrorhyncha*. Table 1 (after Maréchal et al., 1978) lists some similarities and differences among *Phaseolus*, *Dysolobium* and the subtribes of *Vigna* (including *Dolichovigna*, which is recognized as a genus by Maréchal).

Vigna subgenus *Macrorhyncha* is the most difficult group to separate from subgenus *Dolichovigna* and from *Dysolobium*. *Macrorhyncha* differs from the other two in the shape of the wing petal (no hemi-circular upper margin, auricles lacking or only slightly developed), in the callus of the standard (the other two lack an x-shaped callus), and in the pilosity of the style. All three groups have a bundle of hairs along the style. However, the bundle of *Dolichovigna* is much smaller than that of *Macrorhyncha*, while the one of *Dysolobium* also surrounds the stigma. A similarity between *Dolichovigna* and *Macrorhyncha* may be found in the stigma, which is obliquely hoof-like in both subgenera (Verdcourt, 1970b). Of all subgenera of *Vigna*, *Macrorhyncha* is the most closely related one to *Dolichovigna* and to *Dysolobium* (Verdcourt, 1970b; Maréchal et al., 1978).

Table 1. Differences and similarities among *Dysolobium*, *Phaseolus* (s.s.) and the subgenera of *Vigna* (after Maréchal et al., 1978).

	<i>Vigna</i>	<i>Plectotropis</i>	<i>Ceratotropis</i>	<i>Lasiocarpa</i>	<i>Sigmoidotropis</i>	<i>Haydonia</i>	<i>Macrorhyncha</i>	<i>Dolichovigna</i>	<i>Dysolobium</i>	<i>Phaseolus</i>
Base of stipules elongated	+ / -	+	+	+	-	-	-	-	-	-
Standard symmetric	+	-	-	-	-	-	+	+	+	+
Keel with an unilateral pocket	-	+	+	-	-	-	-	-	-	-
Keel and style spirally coiled	-	-	-	+ / -	+ / -	-	-	-	-	+
Style straight	+ / -	-	-	-	-	+	-	-	-	-
Style beaked	+	+	+	+ / -	+ / -	+ / -	-	-	-	+
Corolla yellow	+ / -	-	+	+	-	+ / -	-	-	-	+ / -
Pollen triporate (+) or tricolporate (-)	+	+	+	+	+ / -	+	-	-	-	-
Exine with wide reticulation (+), fine (-), or without (o)	+	+	+	+	+ / o / -	o	+ / o	+	-	-

On the genus level *Dysolobium* can easily be distinguished from the other genera, as shown above. The characters are: the pilosity of the style, which is partly along the style and partly surrounding the stigma (fig. 1d); the shape of the wing (fig. 1b), with its hemi-circular upper margin; the woody, velvety pods, with their almost circular to subquadrangular transverse section (also between the seeds), and large, firm septa.

Dysolobium subgenus *Dolichovigna* (only containing *Vigna pilosa* and *V. rhombifolia*) is transferred (back) to *Vigna*, because it partly lacks the above mentioned characters. Like *Dysolobium* it has velvety pods, but the pods of *Dolichovigna* are less cylindrical to usually flat, not woody and possess no large, firm septa. *Dolichovigna* also possesses a wing with a hemi-circular upper margin (fig. 2b), but this one is, unlike that of *Dysolobium*, auricle-like. The pollen of *Dolichovigna* has a widely reticulate exine, just like most *Vigna* species, that of *Dysolobium* has a finer reticulation (Maréchal et al., 1978). Both taxa also differ in the pilosity of the style (see above and fig. 1d and 2d). Pilosity of the style is a generally heavily weighed character (subtribe division!), therefore it is enough, certainly with the other characters, to separate *Dolichovigna* from *Dysolobium*. Later on in this paper the position of *Dolichovigna* will be discussed.

GEOGRAPHY

The distribution of the genus *Dysolobium* is in the continental part of Southeast Asia.

Three of the species are partly or solely found in India and one of them is also found in the Malesian area. It is tried to fit these distribution patterns into the patterns found by Clayton & Panigrahi (1975) for Indian grasses and by Van Steenis (1979) for Malesian plants.

Dysolobium lucens, an endemic of Burma, fits nicely in the Burmese region of Clayton & Panigrahi (their map 5c). *Dysolobium tetragonum*, restricted to West Bengal and Assam (India), does not fit into any of the patterns of Clayton & Panigrahi.

The remaining two species are much more widespread. *Dysolobium grande*, ranging from East India to Southwest China and Thailand, is part of the Deccan region (25% isochore, map 3 of Clayton & Panigrahi, 1975). *Dysolobium dolichoides* is even more widespread, reaching further southeast to Java. Clayton & Panigrahi describe this species as plants of the Southeast Asia-Malayan region (25% isochore, their map 6), a pattern corresponding with the pattern Van Steenis (1979) found for the Indo-Malesian widespread species absent eastwards of Java.

Dysolobium tetragonum shows a disjunction as this species is apparently absent in Bangladesh; this can be due to the poor floristic knowledge regarding this country. The same possibly applies to Burma, because of the gap in the distribution of *D. dolichoides*.

Dysolobium dolichoides is absent from the everwet Sunda Shelf; this species surrounds it and is found in regions (Java) with an annual drought. Possibly, *D. dolichoides* dispersed to Java during glacial periods, when the Sunda Shelf was dry and less

everwet, disappearing from the Shelf during interglacial periods with a higher wetness (Audley-Charles, 1981).

All species are present in areas with a seasonal dry period, the latter may even be severe, which indicates that the plants need a seasonal drought in their development.

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DYSOLOBIUM

- Dysolobium* (Benth.) Prain, *J. As. Soc. Beng.* 66, ii (1897) 425; *Ann. Roy. Bot. Gard. Calc.* 9 (1901) 28; Backer & Bakh. f., *Fl. Java* 1 (1963) 641; Hutch., *Gen. Fl. Pl.* 1 (1964) 443; Maréchal, *Bull. Jard. Bot. Nat. Belg.* 47 (1977) 483; Maréchal et al., *Boissiera* 28 (1978) 236; Thuân, *Fl. Camb., Laos et Viêt-Nam* 17 (1979) 168. — *Phaseolus* sect. *Dysolobium* Benth. in *Miq., Pl. Jungh.* (1852) 239, in footnote; Benth. & Hook. f., *Gen. Pl.* 1 (1865) 539, excl. Wallich, *Pl. As. Rar. t.* 6 (*Phaseolus fuscus*); Taub. in E. & P., *Nat. Pfl. Fam.* 3, 3 (1894) 380. — *Phaseolus* subg. *Dysolobium* Baker in Hook. f., *Fl. Br. India* 2 (1876) 204, excl. *Phaseolus fuscus*. — *Dysolobium* subg. *Dysolobium*; Maréchal, *Bull. Jard. Bot. Nat. Belg.* 47 (1977) 483; Maréchal et al., *Boissiera* 28 (1978) 237; Thuân, *Fl. Camb., Laos et Viêt-Nam* 17 (1979) 169. — *Lectotype*: *D. dolichoides* (Roxb.) Prain (vide Hutchinson, 1964).
- Vigna* subg. *Plectotropis* Baker in Hook. f., *Fl. Br. India* 2 (1876) 206, p.p.

Herbaceous to woody climbers, winding left. Vegetative parts pubescent to sericeous when young. Axis smooth to somewhat ribbed. *Leaves* spirally arranged, pinately trifoliolate. Stipulae with prominent veins, caducous. Stipellae caducous. *Leaflets* usually rhomboid to elliptic to linear; terminal one usually somewhat larger than the lateral ones; the latter asymmetric with the basiscopic side larger than the acroscopic side; base rounded to acute; margin entire, sometimes sinuate in the lower half; apex cuspidate to mucronate; hairs usually bulbous based, sometimes small stalked glands on the lower surface; nervature reticulate, especially prominent on the lower side, with the nerves parallel to the base and the veins perpendicular to the nerves. *Pseudoracemes* axillary; bracts caducous, usually covering a dormant bud, latter consisting of several bracts. Brachyblasts 2- or 3-flowered, one of which usually maturing; bracts 3-nerved, caducous. Bracts to the flowers 1- or 3-nerved, caducous. *Bracteoles* just below the calyx, subpersistent in fruit. *Calyx* campanulate, 4-lobed, (sub)persistent in fruit, pubescent outside, puberulous inside the lobes, glabrous inside the cup; lower lobe elongated; upper lobe with a bifid apex. Corolla papilionoid, glabrous. *Standard* shortly clawed, lateral auricles slightly developed; apex retuse with a small backward fold. *Wings* about as long as the horizontal part of the keel;

claw slender; blade with a long recurved upper auricle; lower auricle small, situated halfway the blade; lateral pocket at most only developed as a fold; upper margin hemi-circular. *Keel* with a long, slender claw; blade strongly curved upwards under an almost straight angle, connate from apex to bend, upper auricle and pocket usually absent or only slightly developed; apex sometimes elongated into a long recurving tube. *Stamens* all of the same length or alternately longer and shorter; vexillary stamen free, usually with a small half loop at the base of the filament; other 9 stamens partly connate; anthers ellipsoid, subbasifixed. Disc consisting of 10 connate lobes. Ovary sessile, laterally flattened, sericeous; style filiform, bending upwards, glabrous or sericeous in the lower part, with a tuft of hairs along the upper side, subapically transversely surrounding the stigma; latter oblique, situated at the upper side of the style. *Pod* linear, woody, not beaked, circular to subquadrangular in cross-section, velutinous, with or without rims along the sutures (sutures sunken or not, respectively), dehiscent along both sutures; septa oblique, 1- or usually 3-layered. *Seeds* spherical, vertically or horizontally arranged, glabrous to velutinous, dark brown to black; hilum oval; aril consisting of two unequal lateral lobes, clasping the funicle; latter basically enlarged and overlapping the aril; radicular lobe absent; lens sometimes somewhat raised. *Embryo* with a folded, dorso-ventrally flattened radicle; plumule minute; cotyledons firm.

Collectors' notes. Flowers reddish or blue or usually purple; standard with a yellow spot near its base. Pods brown velvety.

Distribution. Two species are endemic, one in Burma, the other in India. The other two species are widespread, ranging from India to at most Southwest China and Java.

Ecology. Climbers in usually secondary vegetations, situated in a moist habitat within areas with a (severe) seasonal drought.

Pollen. Exine with a fine reticulation (Maréchal et al., 1978), tricolporate.

KEY TO THE SPECIES

- 1 a. Pod with 2–4 mm broad rims along the sutures (sutures sunken). Leaflets either linear and then flowers shorter than 2 cm, or ovate to rhomboid and then flowers longer than 2 cm 2
- b. Pod without rims (sutures not sunken). Leaflets ovate to elliptic to rhomboid; flowers shorter than 2 cm 3
- 2 a. Leaflets broadly ovate to rhomboid. Inflorescence (17–)25–80 cm long. Flowers over 2 cm long. Pod 13–18.5 cm long 2. *D. grande*
- b. Leaflets linear. Inflorescence 2.5–4 cm long. Flowers shorter than 2 cm. Pod 5–6 cm long 4. *D. tetragonum*
- 3 a. Standard 6–11 mm broad. Keel 10–12 mm long. Pod 3.5–7 cm long; hairs adpressed, over 2 mm long. Embryo horizontally in pod 1. *D. dolichoides*
- b. Standard c. 15 mm broad. Keel c. 19 mm long. Pod 7–18 cm long; hairs patent, shorter than 1 mm. Embryo vertically in pod 3. *D. lucens*

1. *Dysolobium dolichoides* (Roxb.) Prain

D. dolichoides (Roxb.) Prain, J. As. Soc. Beng. 66, ii (1897) 427 (see also p. 429 sub *Vigna dolichoides*); Ann. Roy. Bot. Gard. Calc. 9 (1901) 29, 30, pl. 38; Koord., Exk. Fl. Java 2 (1912) 408 (see also sub *Vigna dolichoides*); Backer & Bakh.f., Fl. Java 1 (1963) 641; Bell et al., Bioch. Syst. Ec. 6 (1978) 201; Maréchal et al., Boissiera 28 (1978) 237; Thuân, Fl. Camb., Laos et Viêt-Nam 17 (1979) 169. – *Phaseolus dolichoides* Roxb. [Hort. Beng. (1814) 54, nom. nud.] Fl. Ind. 3 (1832) 290; Benth. in Miq., Pl. Jungh. (1852) 239, in footnote; Kurz, J. As. Soc. Beng. 43, ii (1874) 185 (the combination *Canavalia dolichoides* only suggested). – *Vigna dolichoides* Baker in Hook. f., Fl. Br. India 2 (1876) 206; Prain, J. As. Soc. Beng. 66, ii (1897) 429 (see also p. 427 sub *D. dolichoides*); Koord., Exk. Fl. Java 2 (1912) 408 (see also sub *D. dolichoides*). – *D. dolichoides* var. *dolichoides*; Maréchal et al., Boissiera 28 (1978) 237. – Type: Roxburgh Icon. 1889 (K), Chittagong.

[*Mucuna recta* Wall., Cat. (1831/32) 5625, nom. nud., based upon Wallich 5625 (K).]

Dolichos dasycarpus Miq., Fl. Ind. Bat. 1 (1855) 186; Gagnep., Fl. Gén. I.-C. 2 (1916) 244, f. 24: 5–9. – Type: Horsfield s.n. (K), Java, Soerakarta.

Dolichos schomburgkii Gagnep., Not. Syst. 3 (1914) 190; Fl. Gén. I.-C. 2 (1916) 241; Craib, Fl. Siam. Enum. 1 (1928) 460. – *Dysolobium dolichoides* var. *schomburgkii* Maréchal, Bull. Jard. Bot. Nat. Belg. 47 (1977) 483; Maréchal et al., Boissiera 28 (1978) 237; Thuân, Fl. Camb., Laos et Viêt-Nam 17 (1979) 169. – Type: *Schomburgk 300* (K), Thailand, Bangkok.

Stems herbaceous to woody, smooth to slightly ribbed. Stipulae ovate, 1.5–5 by 0.5–2 mm. Rachis: infrajugal part 2.5–8.5 cm long, ultrajugal part 0.5–4 cm long. Stipellae linear, 1.5–3(–4) by 0.5–1 mm. Petiolule 2–5 mm long. *Leaflets* ovate to elliptic to usually rhomboid, 3–16.5 by 2–13 cm; base rounded to obtuse; margin entire to sometimes sinuate; apex (sometimes retusely) mucronate; nerves 2–6 on either side of the midrib; stalked glands sometimes present on the lower side. *Pseudoracemes* short, 3–12 cm long, of which 0.5–4 cm peduncle; bracts ovate, 1.5–2.5 by c. 0.5 mm. Brachyblasts 2-flowered; bracts ovate, c. 1.5 by 0.6 mm. Bracts to the flowers broadly ovate to ovate, 1.5–2.5 by c. 1 mm. Peduncle 2–5 mm long. *Bracteoles* deltoid to ovate, 0.8–2 by 0.6–0.8 mm, 3-nerved. *Calyx* without brown cells; cup 2.5–3 mm long; lower lobe deltoid to triangular, 2–4 by c. 2 mm; lateral lobes deltoid, 1–2 by c. 1.5 mm; upper lobe deltoid, 1–2 by c. 3 mm. *Standard* with a 0.5–1.5 mm long claw; blade suborbicular to broadly elliptic, 6–11 by 5–7 mm high, basal auricles slightly developed, basal callosities absent. *Wings* with a 1–2.5 mm long claw; blade obovate to elliptic, 5–7 by c. 5 mm; upper auricle recurved, lower auricle recurved, lateral pocket absent. *Keel* with a c. 5 mm long claw; blade elliptic, 5–7 by 3–4 mm, upper auricle slightly developed, may differ in length per flower, pocket absent, apex of both blades together somewhat inrolled as a very short tube. *Stamens* alternately longer (4–8 mm) and shorter (3–7 mm); anthers c. 1 mm long. Disc consisting of 0.5–1 mm long lobes. Ovary with 5–10 ovules, 4–6 mm long; style c. 7 mm long; stigma 0.2–0.3 mm long. *Pod* 3.5–7 by 0.8–1.7 cm, without rims, whirling open into 0.25–1.5 turns of a spiral; hairs adpressed, over 2 mm long. *Seeds* 3–7, 4–7 by 4–5 mm, glabrous or velvety; hilum c. 1.5 by 1.3 mm. *Embryo* horizontally in pod, with a c. 1.5 mm long radicle; plumule minute.

Collectors' notes. Flowers mauve to purple; standard with a darker venation and a yellow spot near its base. Pods brown when young, old ones yellowish velvety.

Distribution. E. India, E. Bangladesh, Thailand, Cambodia, Central & East Java. According to Thuân (1979) also found in Vietnam.

Ecology. Lowland. In areas with a seasonal drought, like hedges, brushwood, *Imperata* fields, watersides, village edges.

Biochemical compounds. Bell et al. (1978) record *D. dolichoides* as devoid of canavanine.

Notes. *Dysolobium dolichoides* var. *schomburgkii* is reduced to the type variety because the distinctive character, the sinuation of the leaflets, is not constant. Even the type specimen (*Schomburgk 300*) has leaflets with a sinuate margin as well as leaflets with an entire margin.

Several specimens possess leaves with small stalked glands at the abaxial side of the leaves. As plants with and without these glands appear in the same area, no taxonomical value has been attributed to this character.

2. *Dysolobium grande* (Benth.) Prain — Fig. 1.

D. grande (Benth.) Prain, J. As. Soc. Beng. 66, ii (1897) 427; Ann. Roy. Bot. Gard. Calc. 9 (1901) 28, 29, pl. 36; Craib, Contr. Fl. Siam (1912) 66; Fl. Siam. Enum. 1 (1928) 456; Baudet, Rech. Class. Gén. Pap.-Phas., Thesis (1977) 120; Maréchal, Bull. Jard. Bot. Nat. Belg. 47 (1977) 483; Bell et al., Bioch. Syst. Ec. 6 (1978) 201; Maréchal et al., Boissiera 28 (1978) 239. — *Phaseolus grandis* Wall. [Cat. (1831/32) 5602, nom. nud.] ex Benth. in Miq., Pl. Jungh. (1852) 239, in footnote, non Dalzell; Kurz, J. As. Soc. Beng. 43, ii (1874) 185. — *Canavalia grandis* Kurz, J. As. Soc. Beng. 45, ii (1877) 252. — *Dolichos grandis* Gagnep., Fl. Gén. I.-C. 2 (1916) 248. — Type: Wallich 5602 (BM, K), Nepalia.
Phaseolus velutinus Grah. [ex Wall., Cat. (1831/32) 5615, nom. nud.] ex Baker in Hook. f., Fl. Br. India 2 (1876) 204. — Type: Wallich 5615 (K).

Stems herbaceous to woody, somewhat quadrangular. Stipulae triangular to deltoid, 1.5–4.5 by 1.5–2 mm. Rachis: infrajugal part 7–18 cm long; ultrajugal part 2–5.5 cm long. Stipellae narrowly triangular to linear, 3–5 by 0.3–1 mm. Petiolule 3–8 mm long. Leaflets broadly ovate to rhomboid, 7–19 by 5–15 cm; base rounded to obtuse; margin entire; apex cuspidate; nerves 4–6 on either side of the midrib, veins more prominently developed below the lowest nerves of the terminal leaflet and below the lowest nerve of the basiscopic side of the lateral leaflets; stalked glands sometimes present. *Pseudoracemes* more or less many-flowered, long, (17–)25–80 cm long with a (10–)14–59 cm long peduncle; bracts ovate, c. 4 by 1 mm. Brachyblasts 2- or 3-flowered; bracts broadly ovate, c. 1.5 by 1.5 mm. Bracts to the flowers broadly ovate, c. 1.5 by 1 mm. Peduncles (0.3–)0.6–1.6 cm long. *Bracteoles* reniform, 2–4 by 1.2–2 mm, only midrib visible. *Calyx* without brown cells in the cup, latter 5–9 mm long; lower lobe triangular, 6–8 by c. 7 mm; lateral lobes deltoid, 2.5–4 by c. 4 mm; upper lobe deltoid, 2.5–4 by c. 4 mm, basal callosities and auricles slightly developed. *Wings* with a c. 11 mm long claw; blade obovate, 1.3–2.4 by 1.1–1.5 cm, with a recurved upper auricle, lower auricle curved forwards, lateral pocket absent. *Keel* with a c. 19 mm long claw; blade without auricles and pockets, apex shaped into a very long (c. 25 mm), recurved tube; blade minus tube c. 20 by 10 mm. *Stamens* all of the same length, 4.5–6 cm long; anthers c. 2 mm long. Disc

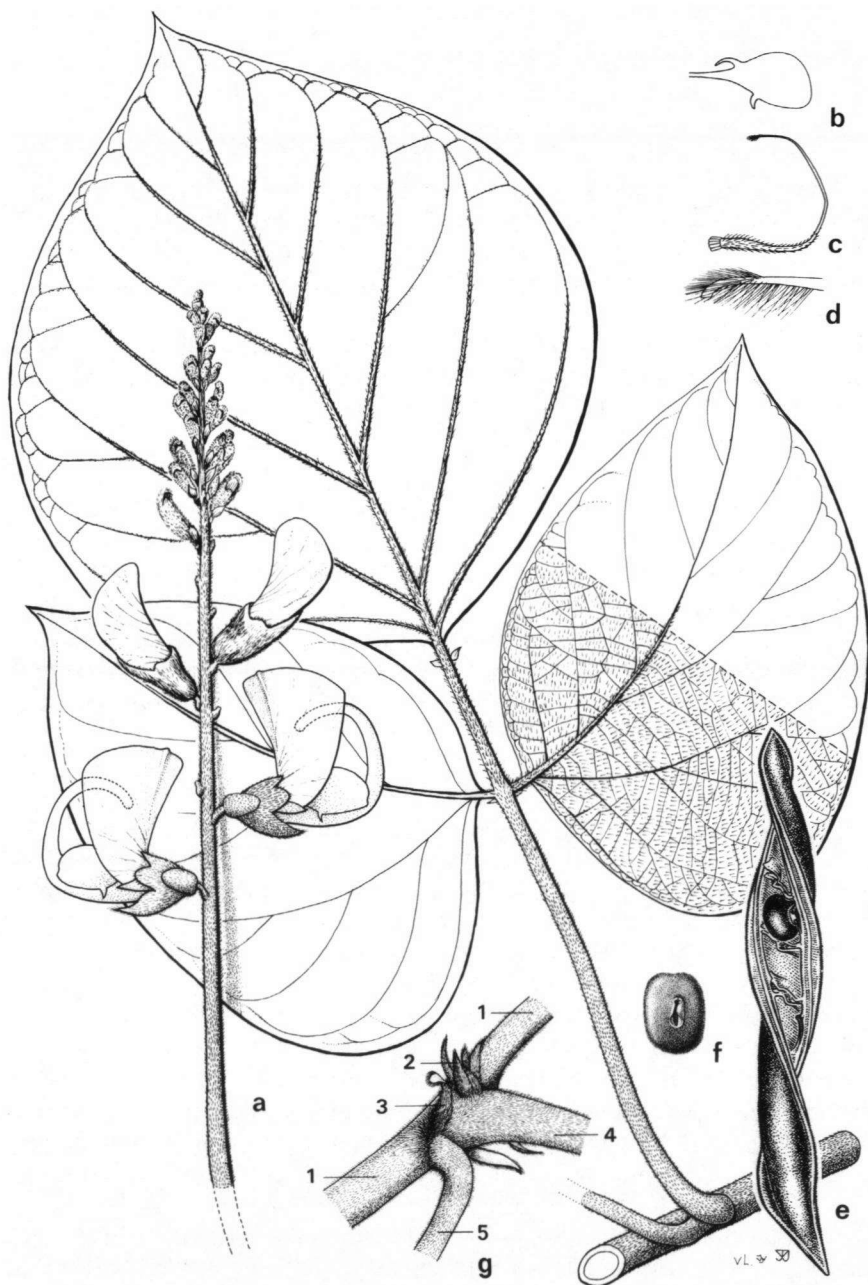


Fig. 1. *Dysolobium grande* (Benth.) Prain. a. Habit, $\times \frac{1}{2}$; b. wing petal, $\times \frac{1}{2}$; c. gynoecium with disc, $\times \frac{1}{2}$; d. stigma, $\times 5$; e. pod, $\times \frac{1}{2}$; f. seed, $\times 1$; g. dormant bud (1: stem, 2: dormant bud, 3: stipule, 4: inflorescence, 5: leaf), $\times 1\frac{1}{4}$ (a. *Lace* 4106; b–d, g. *Vidal* 5246; e, f. *Kostermans* 259).

consisting of 1.4–2 mm long lobes. Ovary with 3–9 ovules, 1.5–2 cm long; style 3–5 cm long; stigma c. 0.8 mm long. *Pod* 13–18.5 by 1.5–2.3 cm, with a 2–4 mm broad rim along every suture edge, whirling open into 0.25–1.5 turns of a spiral; hairs patent, less than 1 mm long. *Seeds* 3–9, 0.8–1.2 by (0.4–)0.7–1 cm, glabrescent; hilum c. 3 by 1 mm. *Embryo* horizontally in pod, with a c. 3 mm long radicle; plumule minute.

Collectors' notes. Flowers purplish blue, the top shading to dark mauve; in centre of the standard a yellowish spot, edged dark purple. Pods when young green, when old brown hairy.

Distribution. East India, Burma, NW. Thailand, China (Yunnan).

Ecology. Found in wet places within areas with a seasonal drought, like deciduous forest, secondary vegetations, forest edges, river banks, once recorded as hanging in *Lagerstroemia* (Lythraceae). One soil type recorded: sandy loam. The plant is not common. Altitude 100–1250 m.

Vernacular names. Thailand: poo tu kô (Karen), 'mai 'nkuang (Khrua).

Biochemical compounds. Bell et al. (1978) record *D. grande* as devoid of canavanine. Baudet (1977) reports lack of leuco-anthocyanides.

Notes. In fruiting stage *D. grande* is often confused with *Pueraria* (*lobata* var.) *thomsonii*. The pods of both are woody and septate, those of *Pueraria* also with several-layered septa, however, with a large interspace. The funicles clasp the aril in the same way. However, the pods of *Pueraria* lack or have at most only slightly developed rims, furthermore the seeds are round and glabrous. The leaflets of *Pueraria* are elliptic and acute, the pseudoracemes shorter (7.5–25 cm), the lobes of the calyx absolutely and relatively longer.

The pods of *D. grande* also resemble those of *Canavalia*. The latter are woody too, often dehiscent, and have ridges along the upper suture only. *Canavalia*, unlike *D. grande*, lacks the ridges along the lower suture and its pod is not septate; also, *Canavalia* has a prominent, thickened nerve below the rims along the upper suture, absent in *D. grande*. Both *Canavalia* and *Pueraria* are not placed in the Phaseolinae, because they lack hairs on the style.

3. *Dysolobium lucens* (Benth.) Prain

D. lucens (Benth.) Prain, J. As. Soc. Beng. 66, ii (1897) 427; Ann. Roy. Bot. Gard. Calc. 9 (1901) 29, pl. 37. — [*Dolichos lucens* Wall., Cat. (1831/32) 5601, nom. nud.] — *Phaseolus lucens* Benth. in Miq., Pl. Jungh. (1852) 239, in footnote; Kurz, J. As. Soc. Beng. 43, ii (1874) 185. — *Canavalia lucens* Kurz, J. As. Soc. Beng. 45, ii (1876) 252. — *Vigna lucens* Baker in Hook. f., Fl. Br. India 2 (1876) 207. — Type: Wallich 5601 (K; iso in G), Tavoy.

Stems herbaceous to woody, slightly ribbed. Stipulae ovate, c. 3.5–4 by 2 mm. Rachis: infrajugal part 4.2–9 cm long; ultrajugal part 1.2–2.2 cm long. Stipellae ovate, 1.5–2 by c. 0.5 mm. Petiolule 2–6 mm long. *Leaflets* ovate, 6.5–12.5 by 2.8–7 cm; base obtuse; margin entire; apex acute to acuminate; nerves 3–6 on either side of the midrib; stalked glands not observed. *Pseudoracemes* moderately long, 13–19 cm long with a 3.9–7.5 cm long peduncle; bracts ovate, 2–3.5 by 1 mm. Brachy-

blasts 2-flowered; bracts ovate, 1.5–2 by c. 1 mm. Bracts to the flowers broadly ovate, c. 0.5 by 1 mm. Peduncles c. 4.5 mm long. *Bracteoles* ovate, c. 1.5 by 2 mm, 3-nerved. *Calyx* with brown cells; cup 3–5 mm long; lower lobe triangular, 3–4 by c. 2.2 mm; lateral lobes deltoid, 1.5–2 by c. 1 mm; upper lobe deltoid, 0.7–2 by c. 3.5 mm. *Standard* with a 0.5–3 mm long claw; blade orbiculate to obcordate, c. 15 by 12 mm, basal auricles inflexed, basal callosities somewhat developed. *Wings* with a c. 3 mm long claw; blade elliptic to obovate, c. 9 by 3.5 mm; upper auricle long, recurved; lower auricle somewhat recurved; lateral pocket absent. *Keel* with a c. 7 mm long claw; blade elliptic, c. 12 by 6 mm; upper auricle present, pocket absent, apex shortly tube-like. *Stamens* possibly alternately longer and shorter, c. 2 cm long; anthers c. 1.5 mm long. Disc with 1.2 mm long lobes. Ovary with c. 13 ovules; 5–6 mm long; style 10–12 mm long; stigma c. 0.4 mm long. *Pod* 7–18 by 1.6–2 cm, without rims, whirling open into c. 0.75 turns of a spiral; hairs adpressed, less than 1 mm long. *Seeds* 7–15, c. 7 by 7–12 mm, glabrescent; hilum c. 2.5 by 2 mm. *Embryo* vertically in pod, with a c. 1.5 mm long radicle; plumule c. 2 mm long, several initials of leaves present.

Collectors' notes. Flowers reddish.

Distribution. S. Burma.

Ecology. Lowland. Areas with a dry season.

Note. A poorly known species, which in pod strongly resembles the pod of *D. grande*, but the pod of *D. lucens* lacks the rims and the flower is smaller than the flower of *D. grande*.

4. *Dysolobium tetragonum* Prain

D. tetragonum Prain, J. As. Soc. Beng. 66, ii (1897) 427; Ann. Roy. Bot. Gard. Calc. 9 (1901) 30, pl. 39. — *Psophocarpus spec.*, Baker in Hook. f., Fl. Br. India 2 (1876) 212. — Lectotype (here proposed): *Masters s.n.* (K), North Bengal, Alipur Duars. Syntypes: *Heawood s.n.* (K?, n.v.), *G. Mann s.n.* (K?, n.v.), Assam.

Stems woody, longitudinally somewhat ribbed. Stipulae minutely lanceolate (Prain, 1897). Rachis: infrajugal part 1.6–6 cm long; ultrajugal part 0.4–1.5 cm long. Stipellae linear, 1–2.5 by c. 0.3 mm. Petiolule 2–4 mm long. *Leaflets* linear, 9.5–14 by 1.5–2.5 cm; base obtuse; margin entire; apex acute; nerves 4–6 on either side of the midrib; stalked glands not observed. *Pseudoracemes* short, 2.5–4 cm long, of which c. 0.5 cm peduncle; bracts ovate, c. 3 by 2 mm. Brachyblasts 2-flowered, with remnants of the third; bracts already caducous. Bracts to the flowers already caducous. Peduncles c. 1.5 mm long. *Bracteoles* already caducous. Flowers not seen (description obtained from Prain, 1897, 1901): *Calyx* 2.5 mm long; lower lobe lanceolate, others deltoid. *Corolla* 7.5–10 mm long; standard orbicular, 7.5 mm wide; keel hardly beaked. Ovary with c. 9 ovules. *Pod* 5–6 by 1.2–1.6 cm, with c. 3.5 mm broad rims along every suture edge, whirling open into c. 0.75 turns of a spiral; hairs patent, less than 1 mm long. *Seeds* 6–9, 5–6 by 4–6 mm, glabrous; hilum c. 0.9 mm diam. *Embryo* vertically in pod, with a c. 0.7 mm long radicle; plumule minute.

Collectors' notes. Corolla blue.

Distribution. E. India (Assam, N. Bengal).

Notes. An insufficiently known species, of which only one fruiting specimen was seen by us. Therefore, for flower descriptions, the incomplete notes of Prain were used. Unfortunately the drawing in Prain (1901) was made from flowers in bud, and therefore no measurements could be taken.

The pods in *D. tetragonum* are rather small, as in *D. dolichoides* and in *D. lucens*, but the sutures are provided with rims, as in *D. grande*. In its linear leaflets it differs from all other *Dysolobium* species.

VIGNA SUBGENUS DOLICHOVIGNA (HAYATA) VERDCOURT

In the Introduction we remarked that *Dolichovigna* has recently been treated as a subgenus of *Dysolobium*. In the part on the systematic position of *Dysolobium* it is discussed that *Dolichovigna* cannot be maintained as a subgenus of *Dysolobium*. We would like to consider here why *Dolichovigna* is, in our opinion, a subgenus of *Vigna*.

Characteristic for *Vigna pilosa* are the pilose pod, the shape of the wing and the small tuft of hairs on the style. The pod is similar to most pods in *Vigna*: flat to somewhat cylindrical and with incomplete septa; unlike the totally cylindrical pods of *Dysolobium* with complete septa. Pilose pods are also found in *V. clarkei*, which does not belong to the subgenus *Dolichovigna* on other accounts (see below). Therefore, only two characters remain: the convexity of the wing, which has two more or less distinct upper auricles (see fig. 2b) and the typical pilosity of the style (only a small tuft of hairs, c. 1–1.5 mm below the stigma; fig. 2d). In our opinion, these two characters are hardly sufficient to distinguish *Dolichovigna* as a distinct genus, because more characters are in favour for retention in *Vigna*: Verdcourt (1970b) states that the amino-acid pattern of the seeds is that of typical *Vigna*; the wide reticulation of the exine of the pollen too; and the shape of the stigma is the same as in *Vigna* subg. *Macrorhyncha*. Moreover, if *Dolichovigna* is regarded as a genus, other subgenera have to be treated as genera (among the latter transitions prohibit this decision; Verdcourt, 1970b). Therefore, *Dolichovigna* is retained in *Vigna*.

In literature four species are regarded as to belong to *Vigna* subg. *Dolichovigna*: *V. pilosa*, *Dysolobium apioides*, *Dolichovigna rhombifolia*, and *V. clarkei*.

Vigna clarkei was placed near *V. pilosa* by Prain (1897). These species, however, are quite dissimilar, except for the flat, pilose pods. *Vigna clarkei* has longer, yellow flowers, while *V. pilosa* has shorter blue to purple ones. The pod of *V. clarkei* has a short, bent beak; *V. pilosa* has a long, straight one. In the style the most important differences are encountered, the pilosity in *V. clarkei* is much longer and on both sides of the style; moreover, the style in *V. clarkei* is prolonged beyond the stigma (stigma beaked), the stigma in *V. pilosa* is obliquely terminal. Consequently, *V. clarkei* has to be placed in another subgenus of *Vigna*, but unfortunately this was impossible because of the absence of complete or accessible flowers; however, with the aid of Verdcourt's key (1970b) the African subgenus *Vigna* seems to be the most appropriate (*V. clarkei* is Indian).

In this paper *Dysolobium apioides* is regarded as a synonym of *Vigna pilosa*. It is recorded to differ in the size of the leaflets and in the length of the inflorescence.

Dysolobium apioides has smaller leaflets, 2–5 by 1.5–4 cm (*V. pilosa*: 2–16(–19) by 0.9–7.5 cm) and it has shorter inflorescences, 1.5–2 cm long (*V. pilosa*: 1–8(–12.5) cm long). The ranges overlap, consequently *Dysolobium apioides* is united with *Vigna pilosa*.

Dolichovigna rhombifolia was described by Hayata (1919) and transferred to *Dolichos* by Hosokawa (1932). A drawing (Huang & Ohashi, 1977, pl. 580) shows that *Dolichovigna rhombifolia* is not a *Dolichos*, because of the tuft of hairs on the style (which surrounds the stigma in *Dolichos*) and because of the oblique stigma (not terminal as in *Dolichos*). *Dolichovigna rhombifolia* appears to be identical with *Vigna pilosa*, as both have wing petals with the same peculiar shape, the same pilosity of the style, and the same pilose pods. An opinion shared by Ohashi and Tateishi.

Vigna subgenus *Dolichovigna*

Vigna subg. *Dolichovigna* (Hayata) Verdc., Kew Bull. 24 (1970) 561. – *Dolichovigna* Hayata, Icon. Pl. Formos. 9 (1920) 35. – *Dysolobium* subg. *Dolichovigna* Maréchal, Bull. Jard. Bot. Nat. Belg. 47 (1977) 483; Maréchal et al., Boissiera 28 (1978) 239; Thuân, Fl. Camb., Laos et Viêt-Nam 17 (1979) 170. – Type: *Dolichovigna formosana* Hayata (synonym of *Vigna pilosa*).

Climber, winding left. Vegetative parts pubescent to sericeous when young. Stems herbaceous to woody, sometimes tendril-like, somewhat ribbed to angular. *Leaves* spirally arranged, pinnately trifoliate. Stipulae and stipellae caducous. *Leaflets* ovate to rhomboid, terminal one usually somewhat larger than the lateral ones; the latter asymmetric with the basiscopic side larger than the acroscopic side; veins scalariform, the finer ones reticulate. *Pseudoracemes* axillary and terminal. Bracts all caducous; those to the pseudoracemes usually covering a dormant bud. Brachyblasts 2- or 3-flowered. *Bracteoles* closely below the calyx, subpersistent in fruit. *Calyx* campanulate, 4-lobed, subpersistent in fruit; lower lobe elongated; upper lobe with a bifid apex. Corolla papilionoid. *Standard* shortly clawed; lateral auricles prominent, inflexed; basal callosities absent to slightly developed; apex retuse with a small backward fold. *Wings* with a slender claw; blade with a straight to recurved upper auricle; upper margin hemi-circular, auricle-shaped; lower auricle slightly developed to prominent, recurved, subapically situated; lateral pocket absent to slightly developed. *Keel* with a long, slender claw; blade strongly curved upwards under an almost straight angle, connate from apex to bend; upper auricle slightly to distinctly developed; pocket small; apex not tube-like. *Stamens* all of the same length; vexillary stamen free, other 9 stamens partly connate; anthers ellipsoid, subbasifixed. Disc consisting of 10 connate lobes. Ovary laterally flattened; style filiform, bending upwards, with a small tuft of hairs, c. 1–1.5 mm below the stigma on the upper side; stigma oblique. *Pod* linear, flat to somewhat cylindrical, velutinous, shortly to longly beaked, dehiscent along the rim-free sutures; septa small, 1- or sometimes 3-layered; funicle basically enlarged. *Seeds* spherical, glabrous; hilum oval; aril consisting of two unequal lateral lobes; radicular lobe and lens absent or inconspicuous. *Embryo* horizontally in pod, with a folded, dorso-ventrally flattened radicle; cotyledons firm.

Distribution. One species widespread from India to Java (absent from the Sunda Shelf).

Pollen. Exine coarsely reticulate; tricolporate (Maréchal et al., 1978).

5. *Vigna pilosa* (Willd.) Baker — Fig. 2.

V. pilosa (Willd.) Baker in Hook. f., Fl. Br. India 2 (1876) 207; Prain, J. As. Soc. Beng. 66, ii (1897) 429; Backer, Voorl. Schoollf. (1908) 91; Koord., Exk. Fl. Java 2 (1912) 409; Craib, Contr. Fl. Siam (1912) 66; Ridley, Fl. Mal. Pen. 1 (1922) 568; Merr., Enum. Philip. Fl. Pl. 2 (1923) 320; Keuchenius, Meded. Proefstat. Thee 90 (1924) 43; Heyne, Nutt. Pl. Ned. Indië ed. 2, 2 (1927) 842; Craib, Fl. Siam. Enum. 1 (1928) 457; Backer & Bakh. f., Fl. Java 1 (1963) 642, 643; Verdc., Kew Bull. 24 (1970) 561; Huang & Ohashi, Fl. Taiwan 3 (1977) 415, pl. 666. — *Dolichos pilosus* Willd., Sp. Pl. III, 2 (1802) 1043; Roxb., Fl. Ind. 3 (1832) 312; Gagnep., Fl. Gén. I.-C. 2 (1916) 239, 240, f. 24: 1–4. — *Dolichovigna pilosa* Hosokawa, J. Soc. Trop. Agr. Formosa 4 (1932) 488, in syn. — *Dysolobium pilosum* Maréchal, Bull. Jard. Bot. Nat. Belg. 47 (1977) 483; Maréchal et al., Boissiera 28 (1978) 239; Thuân, Fl. Camb., Laos et Viêt-Nam 17 (1979) 170. — Type: *Willdenow s.n.* (B, ?), IDC 7440, no 13399.

[*Phaseolus difformis* Wall., Cat. (1831/32) 5599, nom. nud., based on *Wallich 5599* (BM, K), India.]

Dolichos apioides Gagnep., Not. Syst. 3 (1914) 186, 187; Fl. Gén. I.-C. 2 (1916) 238, 239. — *Dysolobium apioides* Maréchal, Bull. Jard. Bot. Nat. Belg. 47 (1977) 483; Maréchal et al., Boissiera 28 (1978) 240; Thuân, Fl. Camb., Laos et Viêt-Nam 17 (1979) 171. — Type: *Thorel s.n.* (P?, n.v.), Laos, Bassac.

Dolichovigna formosana Hayata, Icon. Pl. Formos. 9 (1919) 35, 36, pl. 3. — Type: *Matsuda s.n.* (n.v.), Taiwan, Kiukyokudo.

Dolichovigna rhombifolia Hayata, Icon. Pl. Formos. 9 (1919) 36, 37; Maréchal et al., Boissiera 28 (1978) 240. — *Dolichos rhombifolius* Hosokawa, J. Soc. Trop. Agr. 4 (1932) 488; Chuang & Huang, Leg. Taiwan, JCRR An. Ind. 7 (1965) 48, f. 69 (n.v.); Huang & Ohashi, Fl. Taiwan 3 (1977) 273, pl. 580. — Type: *Sasaki s.n.*, Dec. 1911 (?), Taiwan, Karapin.

Stipulae ovate to triangular, 1.5–3.5(–5) by 0.5–1 mm. Rachis: infrajugal part 1.2–6.5(–12) cm long; ultrajugal part 0.2–2.3(–3) cm long. Stipellae linear, 0.8–2.5 by c. 0.2 mm. Petiolule 1–4 mm long. *Leaflets* ovate to rhomboid to linear, 2–16(–19) by 0.9–7.5 cm; base obtuse to acute; margin entire; apex obtuse to mucronate; nerves (2–)3–6 on either side of the midrib; stalked glands seemingly absent. *Pseudoracemes* short, 1–8(–12.5) cm long with a 0.2–4.5(–8.5) cm long peduncle; bracts ovate, c. 2 by 1 mm. Brachyblasts very broad, ovate, c. 1.3 by 1.2 mm; bracts ovate to linear, 1–1.8 by 0.2–0.7 mm. Bracts to the flowers ovate, 0.7–2 by 0.2–0.5 mm. Peduncle 1.5–6 mm long. *Bracteoles* ovate to triangular, 1–2.5 by 0.4–1 mm, 1- or 3-nerved. *Calyx* pubescent outside, puberulous inside the lobes, glabrous inside the cup; cup 2.5–5 mm long, sometimes with brown cells; lower lobe triangular, 3.5–6 by c. 2 mm; lateral lobes deltoid, 1.5–3 by 2–2.3 mm; upper lobe deltoid, 2–3 by 3–5 mm. *Standard* with a 1–2.2 mm long claw; blade orbicular, 12–15 by 10–14 mm. *Wings* with a c. 3 mm long claw; blade 4–6 by 2–6 mm. *Keel* with a 6.5–7 mm long claw; blade obovate, 11.5–13.5 mm long. *Stamens* 12–14 mm long; anthers c. 1 mm long. Disc with 0.2–1.5 mm long lobes. Ovary with 7–13 ovules, 7–9.5 mm long, velutinous; style 8–12.5 mm long; stigma 0.6–0.8 mm long. *Pod* flat, (6–)8–13.5 by 0.5–0.7 cm, longly beaked, opening into (1.5–)3–6.5 turns of

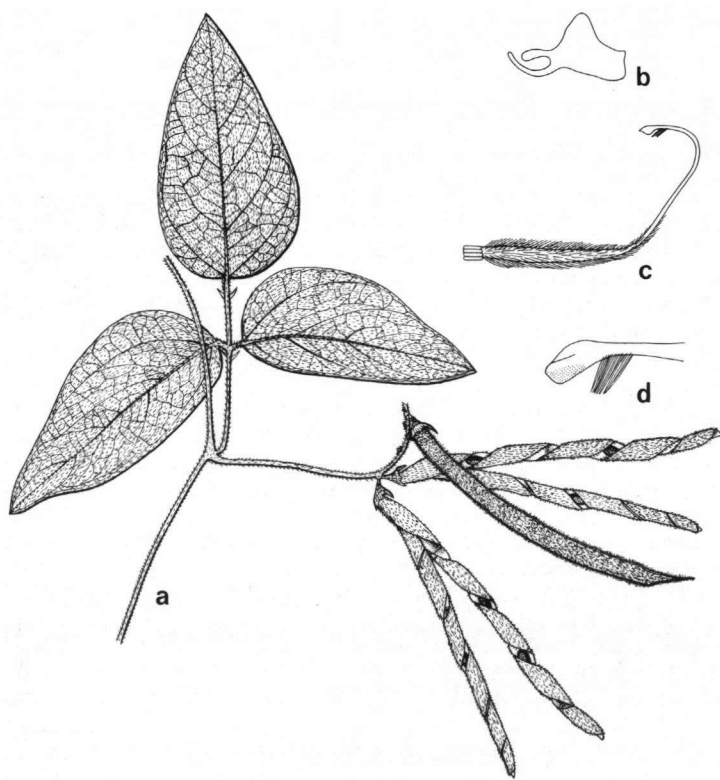


Fig. 2. *Vigna pilosa* (Willd.) Baker. a. Habit, $\times \frac{1}{2}$; b. wing petal, $\times 2\frac{1}{2}$; c. gynoeceium with disc $\times 2\frac{1}{2}$; d. stigma, $\times 10$ (a. Wight 754; b–d. Kerr 13449).

a spiral. *Seeds* (5–)7–12, 5–7 by 3.5–4 mm; hilum c. 1.5 by 1 mm. *Embryo* with a c. 1 mm long radicle; plumule with c. 4 small enations of leaves.

Collectors' notes. Stem up to 3 m long, sometimes greyish pilose. Flowering from March to November (although in Java not abundantly). Flowers pink to very bright violet to purple with a reseda-green centre; slightly fragrant. Pods when young yellowish white pubescent, when mature brownish pilose.

Distribution. E. India, Sikkim, Thailand, Taiwan, N. Philippines. According to Maréchal (1978) also found in Burma, Cambodia and Vietnam. Thuân (1979) also mentions Laos and China. Backer & Bakhuizen van den Brink f. (1963) and several others record this species for Java too.

Ecology. On moist places with seasonal drought; in light shade of secondary vegetations or at the edge of forests. Varying in density from unique to common. Altitude 550–1000 m.

Vernacular names. Taiwan-huzimame, kobano-huzimame (Japanese).

Uses. The plant reaches an age of 3 years and older (Keuchenius, 1924), cuttings flower and bear fruits after two years, however; they form a minimal amount of seeds on Java. Heyne (1927) recorded *V. pilosa* as a fertilizer, covering the ground after three months and forming sufficient litter after six months. Chrysomelid beetles damage the leaves.

Poilane (specimen no 14010) recorded the plant as used against béri-béri.

Note. Although the type of *Dolichovigna formosana* was not studied, the name is placed into the synonymy of *Vigna pilosa*, following accounts of Verdcourt (1970b), Huang & Ohashi (1977), Maréchal (1977), and Thuân (1978).

COLLECTIONS STUDIED

The numbers after the collection numbers refer to the numbers of the species as used in this paper. Unnumbered specimens are not cited.

A series 5600: 1.

Backer 4306: 1; 7635: 1; 7830: 1 – Barber 2496: 5 – Beddome 2257: 5 – BKF series 53700: 2 – BS series 9602: 5; 22464: 5; 47105: 5 – Bunchai 1196: 2.

Cavalerie 3674: 2 – Clarke 17393: 1; 26785: 5; 40741: 5 – Constantino 15380: 2.

Das 395: 2.

Griffith 1704: 1.

Haines 515: 5; 3918: 5.

Jenkins 18: 2; 23: 5.

Kerr 1407: 2; 2162: 2; 2695: 5; 3931: 1; 4480: 1; 6464: 5; 9338: 1; 13449: 5; 13596: 5; 16174: 5 – Kostermans 259: 2 – Kurz 1732: 3.

Lace 4106: 2 – Lahaie 2308: 1 – Loher 2291: 5.

Marcan 435: 1 – Meebold 7738: 2 – Melville 4: 2 – Merrill 3674: 5 – Mooney 1622: 5.

Parry 627: 2; 756: 2 – Playfair 313: 5 – PNH series 11716: 5 – Poilane 14010: 5; 28025: 5 –

Prain 360: 5 – Put 1417: 5; 2606: 1.

Robertson 422: 2 – Rock 674: 2 – Rottler 90: 5 – Roxburgh 291: 5; 2397: 1.

Schomburgk 300: 1 – Sørensen c.s. 4683: 5.

Thorel 622: 1.

Vidal 2647: 5.

Wallich 473: 3; 5599: 5; 5600: 1; 5601: 3; 5602: 2; 5615: 2; 5625: 1.